Los Alamos National Laboratory Summer Co-Design School

2011

During the summer of 2011 LANL instituted a new and exciting program for students in Computational Co-Design. We assembled a small, multi-disciplinary team of students from various universities and put them to work on a focused problem in co-design of interest to the Laboratory.

The Boltzmann equation provides high fidelity simulation of a diverse range of kinetic systems. A common application of this equation is to simulate neutral particle transport. The team of applied mathematicians, nuclear engineers, and computer scientists developed a novel algorithm, Quasi-Diffusion Accelerated Monte Carlo (QDA-MC), to solve the neutron transport equation. The algorithm decouples particle scattering and absorption to dramatically reduce the complexity of the stochastic simulation. The change provides good scalability and performance in both traditional multi-core/many-node architectures and GPU-accelerated architectures. While the focus of the summer project was on a one-dimensional system in this study, the lessons learned will be largely applicable to multi-dimensional systems as well.

The students developed Matlab code that fed the development of a canonical serial version in C that was used as a baseline for further development. Additional versions were written in OpenMP, MPI, and OpenCL and these were optimized for milti-core and GPU platforms using an agile, iterative, co-design process. Much of the students' work, including code and documentation, has been released as LANL open source "Neutron Transport Evaluation and Test Suite (HILO), Version 1.0" under LA-CC-11-076. This open source release is available for download at https://github.com/losalamos/HILO.

School Leads	Students	Mentors
Allen McPherson, CCS-7	Han Dong, (SUNY Buffalo)	Timothy Germann, T-1
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This work was funded by the Los Alamos National Laboratory Information Science & Technology Center, led by Frank Alexander.

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Join Us
for
the 2012 Los Alamos
Summer Co-Design School

Based on the productivity and success of the 2011 Co-Design School we intend to run a larger version during the summer of 2012. We plan to form two teams, each working in a different science. We will be seeking qualified students in computer science, physics, applied math, engineering, and other disciplines to work in this exciting area of computational Co-Design as we approach the exascale era. Students have access to state-of-the-art computational clusters with multi-core CPUs and GPUS as well as the freedom to pursue multiple technical approaches to solve the problem.

If you are interested in applying for the 2012 school please contact one of the following:

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or visit http://codesign.lanl.gov.

LA-UR 11-06271